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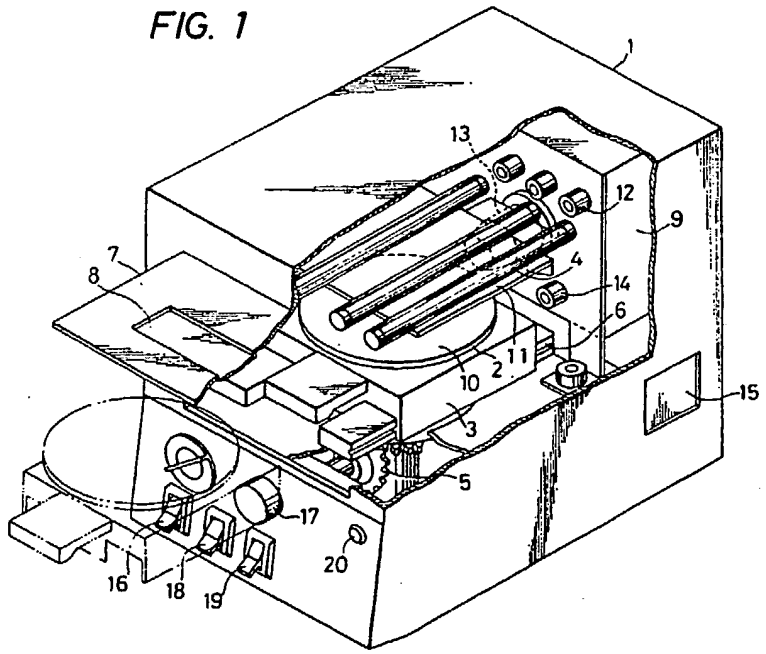
(71) Applicants
Mitsubishi Rayon Kabushiki Kaisha, No. 3—19 Kyobashi 2-chome, Chuo-ku, Tokyo, Japan,
G—C Shika Kogyo Kabushiki Kaisha, 76—1 Hasunuma-cho, Itabashi-ku, Tokyo, Japan
(72) Inventors
Kunihiko Nagao
(74) Agents
Marks and Clerk, 57—60 Lincoln's Inn Fields, London WC2A 3LS

(54) Apparatus for curing resin films coated on dental resin prosthesis

(57) Apparatus for curing resin films coated on dental prosthesis comprises a casing (1), a turntable (2) for supporting the prosthesis slidably disposed in the casing to be movable in or out of the casing, a mechanism (5) for lifting and lowering the turntable by operation of a knob (17) arranged outside of the casing, and an activation energy-radiation lamp (4) disposed in the casing for emitting radiation toward the prosthesis. A door (7) is fitted on a wall of the casing and has a viewing window (8).

FIG. 1



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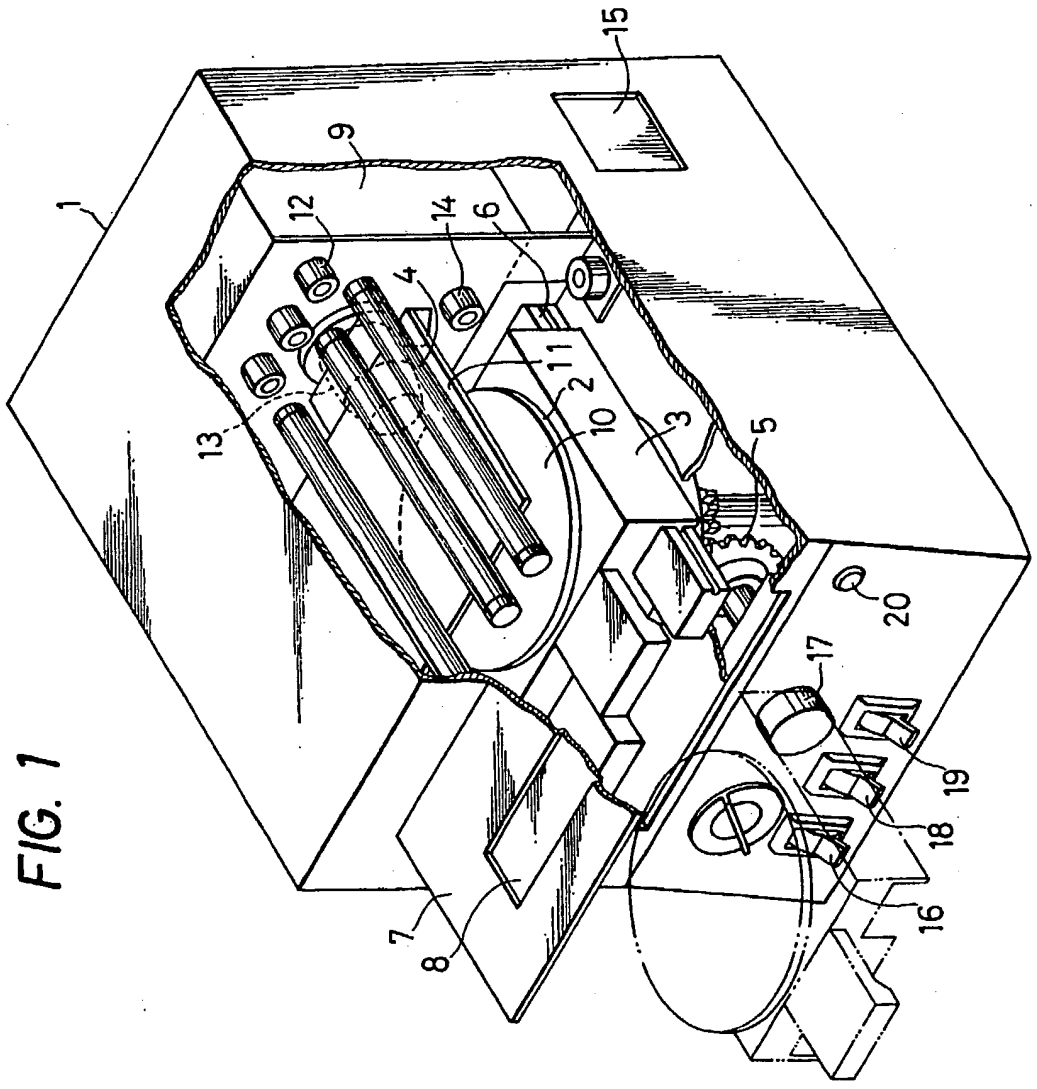
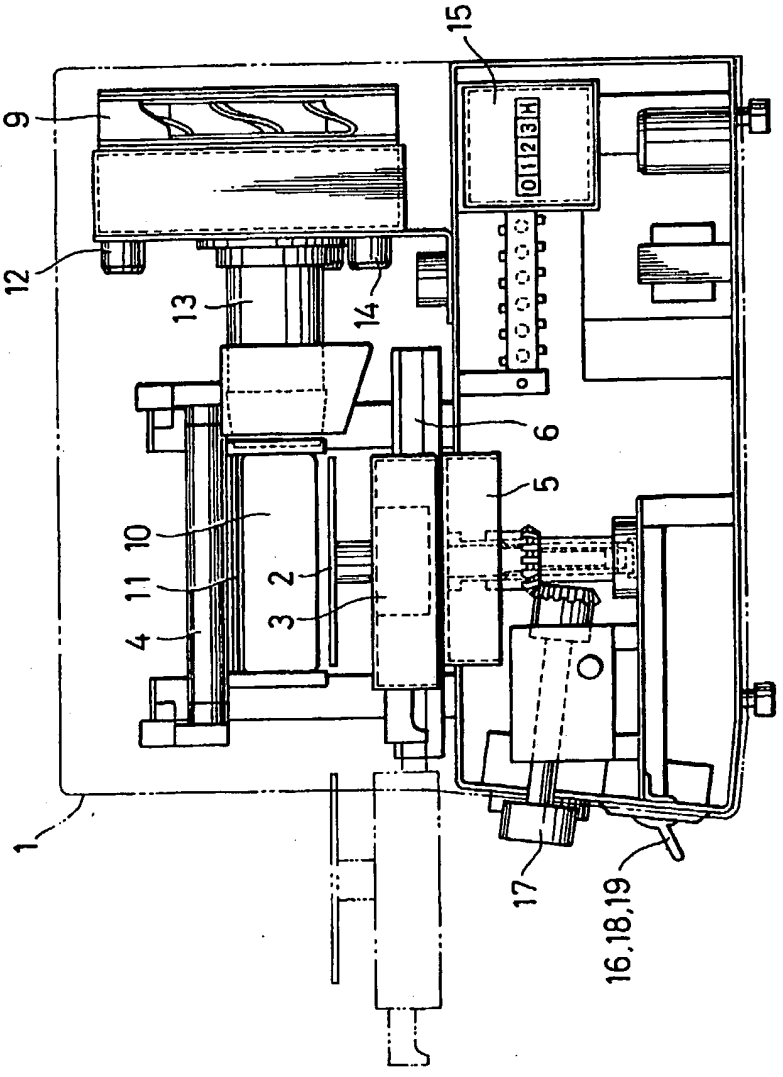


FIG. 1

FIG. 2



SPECIFICATION

Apparatus for curing resin films coated on dental resin prosthesis

The present invention relates to an apparatus for curing resin films coated on dental resin prosthesis, which is designed to coat the prosthesis with a photopolymerizable resin liquid on the surface thereof and cure or set resultant resin films by radiation emitted from a source of activation energy.

Conventional apparatuses for preparing plastics prosthesis coated with an abrasion resistant resin have several disadvantages: they encounter difficulties in obtaining uniform coating and render it impossible to make use of the radiation emitted from a source of activation energy with maximum efficiency, thus resulting in local fluctuations in the quality of cured resin films and failure to obtain a desired coating effect. This is because dental prosthesis have to be cured while placed on or suspended from a turntable kept at a fixed level in a casing.

The present invention provides apparatus for curing films coated on dental prosthesis, comprising a casing on a wall of which is fitted a door having a viewing window. a turntable for supporting the prosthesis slidably disposed in the casing to be movable in or out of the casing, means operable from outside of the casing for lifting and lowering the turntable, and an activation energy-radiation source disposed in the casing for emitting radiation toward the prosthesis.

A build-up of heat generated from the activation energy-radiation source *per se* and hence a lowering of the radiation intensity of activation energy may be prevented by blowing atmospheric air around the radiation source. A change in the shape of the prosthesis to be coated may also be avoided by blowing warm air regulated to a given temperature into a curing chamber defined by the turntable and a quartz plate disposed between the radiation source and a turntable. Optionally, the prosthesis together with the turntable can be removed by means of a slidable mechanism from in the casing without touching them with the hand. Therefore, the prosthesis can be set while maintaining a temperature suitable for the curing reaction of a coating material and the close contact of the coating material with the prosthesis. This ensures time-saving, easy and uniform coating.

The apparatus of the present invention also includes turntable-lifting or -lowering mechanism by which, during curing, the turntable can be visually aligned from the outside of the casing with the zone in which the radiation efficiency reaches a maximum, having regard to the shape of the prosthesis. In this connection, it is noted that the light intensity reaches a maximum at a position about 10 mm away from the radiation source in view of uniformity and other considerations, although it increases further at a position nearer to the lamp.

Thus, the apparatus of the present invention renders it possible to make optimum use of the activation energy radiation, and ensures time-saving and efficient curing. In addition, the apparatus of the present invention provides coatings of uniform quality.

The invention will be further described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a perspective view, partially cut away, of one embodiment of apparatus according to the present invention; and

Figure 2 is a sectional view of the apparatus shown in Figure 1.

The apparatus shown in the drawings comprises a casing 1 on a wall of which is fitted a door 7, a turntable 2 disposed in the casing for holding dental prosthesis, and a driving motor 3 for rotating the tumtable 2. The dental prosthesis held on the turntable 2 are exposed to the radiation emitted from a source of activation energy, while being rotated to receive uniformly thereover part of the radiation from the activation energy source reflected from a reflector plate arranged in the casing.

The radiation intensity of the activation energy source is in inverse proportion to the second power of the distance between the dental prosthesis and the activation energy-radiation source in the form of a lamp 4. It is then required that the dental prosthesis be positioned as close to the lamp 4 as possible. The prosthesis are preferably positioned about 10 mm away from the lamp 4 by vertically moving the turntable *via* a turntable-lifting and -lowering mechanism 5 operated by a knob 17 arranged outside of the casing, while visually monitoring the turntable through a viewing window 8 formed in the door 7. This is because it is important to arrange the dental prosthesis in a zone in which the radiation efficiency of the light energy reaches a maximum, during curing. It is noted that the vertical movement of the turntable may be effected automatically.

The turntable 2 having the prosthesis thereon is longitudinally (or laterally) slidable out of the casing 1 by means of a horizontally movable sliding mechanism 6, while the height of the prosthesis is kept constant. Subsequent application of a coating liquid can be carried out easily and uniformly, since it is then feasible to coat the prosthesis in a stationary state without being subjected to any special limitations, while rotating the turntable.

With the activation energy-radiation lamp 4, the energy efficiency of which has a slight relation to the above-mentioned distance and varies largely dependent upon ambient temperature, a rise of ambient temperature causes a lowering of energy intensity, so that cooling of the lamp 4 is required. To this end, the lower portion of the lamp 4 is separated from a curing chamber 10 by a quartz partition 11 to cool the circumference of the lamp 4 with atmospheric air. This air is obtained by the introduction of fresh air blown by

a fan 9 disposed in the casing 1. The fresh air thus introduced passes through inlets 12, 13 and 14 and is used to cool the lamp 4, warm the curing chamber 10 (with a heater disposed inside of the associated inlet 13) and cool the driving motor 3 for the turntable 2, respectively.

The curing chamber 10 defined by the quartz partition 11 and turntable 2 has a temperature prevailing therein that is not too high to cause deformation of the prosthesis, and is designed to promote curing of the prosthesis by blowing thereonto warm air heated up to about 60°C suitable for the curing reaction. The driving motor 3 for the turntable 2 is always cooled with atmospheric air introduced from the outside of the casing, and can be used for a longer period of time with no danger of overheating. This helps to extend the life of the motor.

The air flows fed by the fan 9 to cool the lamp 4 and control the temperature in the curing chamber 10 are mixed together to cool the casing 1 in its entirety, leaving the casing through a discharge port. Since in this way use is effectively made of the radiation emitted from the source of activation energy, the curing reaction can be efficiently carried out for a shorter period of time and provide coatings of uniform quality.

Preferably, the casing should be formed of a material capable of resisting the light and heat emanating from the lamp 4, such as a metal. The casing preferably also has an internal structure that includes a reflection mechanism to reflect and condense light.

The activation energy-radiation lamp 4 may be any type of lamp capable of giving off activation energy radiation, and may be for example a high- or low-pressure mercury lamp or a lamp capable of giving off ultraviolet rays or visible light.

One or more radiation lamps 4 may be used in combination. A lighting circuit for the lamp 4 may be of the a.c. type; however, it is more preferably of the d.c. type (i.e. the high frequency type), since further increase in energy efficiency is obtained.

The drawings also show an integrator 15, a main switch 16, a driving motor switch 18, a lamp switch 19 and an indicating lamp 20.

The dental prosthesis to be used in the curing apparatus according to the invention typically includes dentures and dental plates formed of materials of resins or resin compositions such as methyl methacrylate polymers or copolymers or polycarbonates.

CLAIMS

1. Apparatus for curing films coated on dental prosthesis, comprising a casing on a wall of which is fitted a door having a viewing window, a turntable for supporting the prosthesis slidably disposed in the casing to be movable in or out of the casing, means operable from outside of the casing for lifting and lowering the turntable, and an activation energy-radiation source disposed in the casing for emitting radiation toward the prosthesis.

2. Apparatus as claimed in Claim 1, in which the activation energy-radiation source is an ultraviolet lamp.

3. Apparatus as claimed in Claim 1, in which the activation energy-radiation source is a visible radiation lamp.

4. Apparatus as claimed in any of Claims 1 to 3, in which a quartz partition is interposed between the activation energy-radiation source and the turntable.

5. Apparatus as claimed in Claim 4, further comprising an air inlet disposed for blowing warm air regulated to a given temperature into a casing chamber formed between the quartz partition and the turntable.

6. Apparatus as claimed in any of Claims 1 to 5, in which a reflecting plate is disposed on the inner surface of the casing.

7. Apparatus as claimed in any of Claims 1 to 6, in which the said means for lifting and lowering the turntable is operable by a knob arranged outside of the casing.

8. Apparatus according to Claim 1 for curing resin films coated on dental prosthesis, substantially as herein described with reference to, and as shown in, the accompanying drawings.

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